



Down-to-Earth Benefits from the Space Shuttle

Marshall puts Shuttle into space and innovative ideas into homes

Since 1970, NASA's Marshall Space Flight Center has been at the forefront of the Space Shuttle Program. The Marshall Center developed the Shuttle's External Tank, Solid Rocket Boosters -- which include the Reusable Solid Rocket Motors -- and its Main Engines, which lift the Shuttle off the launch pad. During its two decades of flight, the Shuttle has supported two space stations; made three maintenance flights to the Hubble Space Telescope; launched planetary missions to study Jupiter, Venus and the Sun; and conducted hundreds of studies in onboard laboratories support by the Marshall Center

Below is a list of innovative ideas and partnerships, illustrating how the Space Shuttle Program at the Marshall Center has improved the quality of life on Earth.

Better health

- Got bad knees? The Marshall Center and Horton's Orthotic Lab Inc. of Little Rock, Ark., have developed a knee brace that will offer freedom of movement to patients suffering from lower extremity weaknesses. The brace – called the

Selectively Lockable Knee Brace – works by allowing the knee to bend when weight is not on the heel. Once weight is placed on the heel, the knee brace locks into position. The brace uses technology used in developing propulsion systems.

- Fiber optic forceps help obstetricians position an infant in the mother's womb prior to delivery -- or in delivery -- without the fear of too much pressure which can harm the infant. Partnering in introducing the forceps are the Marshall Center, Dr. Jason Collins of the Pregnancy Institute in Slidell, La., and Prism, a San Antonio manufacturer of medical products. The forceps have a fail-safe mechanism that ensures no more than 5 pounds (2.27kg) of pressure is exerted on the infant's head, with a pull force limit of 20 pounds (9.07 kg). This should reduce the number of Cesarean section deliveries and injury risk to the mother, and significantly lower the occurrence of fetal injury.



Landmine detonation

- Princess Diana feared for the children who live in the 70 countries strewn with landmines. The Marshall Center and Thiokol Propulsion, Science and Engineering Division in Brigham City, Utah, have produced an easy and safe way to detonate them. The demining device uses NASA Reusable Solid Rocket Motor scrap propellant packed inside a high-temperature flare. The flare is used to burn a hole in the landmine's case and ignite its explosive. When the explosive burns away, the mine is disabled.

Special effects

- You've seen the latest Sci-fi movie. Then you've probably seen NASA at work. An image processing and 3-D graphics tool created for the Space Shuttle serves double-duty by helping Hollywood with special effects,

animation and colorization of old black-and-white television shows and movies. Dynacs Engineering Company Inc. of Palm Harbor, Fla., designed the software. The software is used in the entertainment and medical industries.

Lightning detectors

- Each year in the United States, more people are killed or injured by lightning than by tornadoes, floods and hurricanes combined. NASA and Airborne Research Associates of Weston, Mass., have developed low-cost personal lightning detectors – perfect for boaters, golfers and pilots. The device was originally developed to allow astronauts to detect which clouds held lightning, thus advancing NASA's weather studies. The commercial device is pointed toward a cloud to detect lightning by sensing subtle changes in light presence.

Simulators

- If you've taken a virtual trip to the Moon at your local amusement park, you have actually participated in the same type of simulation NASA astronauts undertake when readying for flight. The Marshall Center and MOOG Inc. of East Aurora, N.Y. designed electric hydraulic actuators or simulators for the Shuttle crew. This led to a partnership with InterActive Simulation Inc. of Toronto and resulted in a computer-guided simulator with a projection system and 11 speakers with digital laser-based sound to add to the realism. Such simulators are found in science museums and recreational attractions.



Thermal protection

- DuraCraft Marine of Delphi, La., Lockheed Martin and NASA's Marshall Center took the thermal protection materials and manufacturing processes

used for the Shuttle's External Tank and created a "thermal livewell" for recreational boats that doesn't take up much-needed space. Non-insulated livewells -- which are used to keep a fisherman's catch alive -- limit the effectiveness of tournament fishing "catch and release" programs.



- Ready for a hot lunch? SouthPointe Products of Montevallo, Ala., approached the Marshall Center and Lockheed Martin with what seemed to be a simple problem. The company had developed nutritious meals for students to take to school for lunch -- but couldn't figure a way to heat it at home and still have it hot at lunchtime. To solve the problem, thermal protection materials developed to keep fuel cold on the Shuttle's External Tank were used to create a "cocoon" for the meal container. The meal -- now in its own thermal container -- will stay hot until lunchtime.
- When the United Service Equipment Company (USECO) of Murfreesboro, Tenn., needed a way to correctly maintain hot and cold food on its Unitrax Food Delivery Cart -- used in hospitals and restaurants -- it turned to NASA and Lockheed Martin. USECO needed to keep milk and ice cream at a temperature between 35 and 40 F (1.7 to 4.4 C) and meals at 150 to 175 F (65.5 to 79.4 C). To solve the problem, a movable "thermal curtain" was designed. The "curtain" utilizes materials used in the Shuttle's External Tank. The new thermal curtain system maintains food at its proper temperature for up to eight hours.

Memory Metals

- What do golf clubs, helicopters, operating rooms and bathtubs have in common with NASA's Marshall Center? They use memory metal alloys developed at Marshall. The alloys -- which return to their original shape -- are being commercialized by Memry Corp. of Brookfield, Conn.

1. Nicklaus Golf Equipment of West Palm Beach, Fla., has developed a line of clubs using Memry's patented technology. The clubs, called IQ Insert™, allow the golfer to put more spin on the ball, giving the ball more "bite" when it hits the green.
2. McDonnell Douglas of Huntington Beach, Calif., and Memry have developed microprocessor-controlled tabs – memory alloy torsion devices -- for helicopter blades that allow the pilots to fine-tune each blade for improved performance and reduced vibration.
3. In medical fields, the shape alloys have been used in catheter guide wires, suture anchors and dental arch wires.
4. Another development is a "smart bathing" system that allows the user to press a single button to control bath water temperature and to turn it off and on.
5. FireChek™, another Memry product, provides for emergency shut down of process control lines that handle flammable and toxic fluids and gases. This means safer industrial plants for those who work in petrochemicals, chemicals, semiconductors, pharmaceuticals, and large oil and gas-fired burners.

Spray it on

- The Marshall Center and USBI of Huntsville have also developed a spray process -- tied to the Space Shuttle's Solid Rocket Boosters -- that can apply a skid-resistant surface to highway beds. The process is faster to apply and, possibly, cheaper than conventional methods.

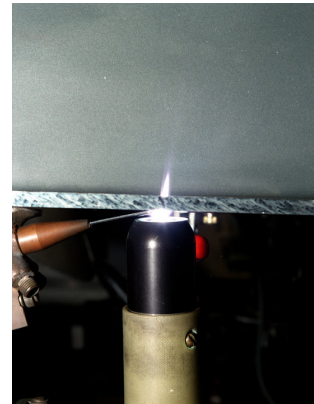


- The Marshall Center hit the roof – literally – when it partnered with USBI Co. of Huntsville, Ala., to develop an environmentally friendly, spray-on coating for metal roof buildings. The coating was originally developed as a heat-resistant coating to the Space Shuttle's Solid Rocket Boosters.

- The next time you use a high-pressure waterjet to clean your patio, think of NASA's Marshall Center. Marshall and USBI of Huntsville use a similar process to clean the Shuttle's two Solid Rocket Boosters. Marshall and USBI developed an advanced stripping system based on hydroblasting – high pressure waterjet cleaning – to slice through the thermal protection material and blow away the particles. Next came a whole new industry. The process – marketed as ARMS (Automated Robotic Maintenance Systems) – uses waterblast streams at 55,000 pounds (24.95 kg) psi controlled by target-sensitive robots. The system – which is economical, fast and safe for the environment and workers -- is used to strip paint and other coatings from aircraft, ships and turbine engine parts.

Top welders

- You don't have to be a rocket scientist: You might just need to be a top welder. The Marshall Center initiated development of Variable Polarity Plasma Arc welding to more easily join the huge sections of the Space Shuttle External Tank. Although the concept dates to 1947, it was never fully developed. Marshall and B&B Precision Machine of Owens Crossroads, Ala., produced a torch with a variable current waveform that allows the system to operate for a preset time in increments in either of two polarity modes for effective joining of light alloys. Companies such as Whirlpool now use a smaller version of the torch to weld appliance parts.
- Another welding project: Marshall, Applied Research Inc. of Huntsville and Martin Marietta Manned Space Systems of New Orleans, La., have developed a welding sensor system for welding components of the Space Shuttle External Tank. The process can be used for home air conditioning compressors, which require a quality, airtight weld.



- What do Cajun fries and the Shuttle's huge External Tank have in common? NASA and Lockheed Martin improved the reliability of stainless steel fry pots used in restaurants -- manufactured by Frymaster of Shreveport, La. -- using the same technique NASA uses to weld the Shuttle's External Tank.